UTILIZATION OF LATEXES WITH ALUMINOUS CEMENT AND GYPSUM COMPOSITION

This application is a continuation-in-part of Ser. No. 14,169, filed Feb. 2, 1987, now U.S. Pat. No. 4,746,365, which application is a continuation-in-part of Ser. No. 702,541, filed Feb. 19, 1985, abandoned.

FIELD OF THE INVENTION

This invention relates to methods and compositions for improving the performance of aluminous cement-/gypsum compositions by adding specific polymer latex emulsions with or without the addition of other wet expansion and drying shrinkage inhibitors.

DEFINITIONS

The term "hydraulic cement" as used herein is intended to mean Portland cements, expansive cements, air entraining Portland cements, pozzolanic cements, slag cement, masonry cement, white Portland cement, colored cement, antibacterial cement, waterproof cement, a mixture of Portland cement and blast furnace cement, refractory cement, self-stressing cement, aluminous cement, and similar materials.

The term "gypsum" as used herein is intended to include gypsum such as is normally understood in the art. This would include calcium sulfate ($CaSO_4$) and its various forms such as calcium sulfate anhydrate, calcium sulfate hemihydrate, and calcium sulfate dihydrate, as well as calcined gypsum, pressure calcined gypsum, and plaster of Paris.

The term "cementitious mixtures" as used herein is intended to mean the combination of hydraulic cement and gypsum in any ratio. These compositions generally possess the characteristic of hardening under water, and include cementitious water-proofings, toppings, protective coatings, and the like as well as mixtures that include aggregates and water such as concrete, mortar, grout, and products made therefrom.

The term "aluminous cement" as used herein is intended to include those cementitious materials normally understood in the art to contain as the main cementitious constituent, mono calcium aluminate ($CaO \times Al_2O_3$). This would include high alumina cement (HAC), calcium aluminate cement, and many other commercially available alumina cements. High alumina cement is normally understood in the art to contain greater than 15% of mono calcium aluminate.

The term "Portlad cement" as used herein is intended to include those cements normally understood in the art to be "Portland cement," such as those described in ASTM Standard C-150. The Type 1 and Type 3 compositions of that standard are especially preferred for use in the present invention, although other forms of Portland cement are also suitable. The Portland cement component of these cementitious mixtures acts to reduce drying shrinkage and increase wet expansion Other cements which act as drying shrinkage inhibitors, although not specifically referred to as Portland cement, are also suitable for use herein so that the term "Portland Cement" should be understood as encompassing those other cements. Examples of drying shrinkage inhibitors include expansion promoters such as expansive cements which are compatible with the other constituents of the system.

The term "drying shrinkage" as used herein is intended to mean contraction of a cementitious mixture in the hardened state, that is, after the final set. The term "drying shrinkage inhibitor" as used herein may include mechanical restraining or reinforcing devices or chemical compounds which may include, but are not limited to, certain latex compounds, water retentivity aids, lime, expansive agents, aluminum sulfate, combinations of cements, fibers, reinforcement, or such devices which reduce or eliminate drying shrinkage.

The term "drying shrinkage inhibitor" may also be used herein to describe components or materials which cause an expansion of the cementitious mixture in the hardened state.

The term "wet expansion" as used herein is intended to mean expansion of a cementitious mixture in the hardened state, that is, after the final set, in moist conditions as determined generally in accordance with ASTM Standard C-157, a test method for length change of hardened cement, mortar, and concrete.

The term "wet expansion inhibition" and "wet expansion counteraction" are used essentially interchangeably herein to describe, as a minimum, a reduction in the wet expansion of the cementitious mixture in the hardened state and/or advantageously maintaining a volume equal to or greater than a system placement volume, and encompass other similar terms such as "wet expansion elimination."

The term "wet expansion inhibitors" encompasses certain latexes and/or lithium salts and other such chemical or physical compounds including mechanical devices, restraining or reinforcing devices which limit the wet expansion.

"Polymer latex emulsions and compounds" as used herein are intended to include those latex emulsions and compounds normally understood in the art to be styrene butadiene, styrene acrylate, acrylic, PVA, and other latex emulsions, compounds and powders.

BACKGROUND OF THE INVENTION

Hydraulic cement, particularly Portland cement, is commonly used throughout construction in many applications. Recent developments in polymer latex technology have provided compatible polymer emulsions and compounds for use in conjunction with these hydraulic cements alone for improvement of properties such as bond strength, tensile strength, and flexural strength.

There have been numerous prior attempts at providing cementitious systems to meet the needs of the construction industry, particularly in the protection, waterproofing, and repair of concrete structures The optimum system should set within a relatively short period of time into a hard mass or coating that has sufficient strength, abrasion resistance, and corrosion resistance. It is also highly desirable that these systems possess impermeability to fluids particularly aqueous solutions. Also, such systems should not undergo excessive hardened volume changes under either wet or dry conditions.

For commercial use, these types of cementitious systems must also possess good bonding characteristics to damp or dry surfaces, early as well as long term strength, and practical field workability. They should be capable of withstanding freezing and thawing, as well as the action of salts, solvents and other corrosive substances. Although there have been a number of cementitious mixtures that possess one or more of the above-described desirable properties, none of the prior art to date has been able to achieve all of the foregoing in one composition and previous attempts have only